ABSTRACT

Quartz crystal tuning fork resonators, capable of vibrating in a flexural mode, having a plurality of tuning fork tines attached to a tuning fork base, and novel shapes, and electrode configurations, are disclosed. The resonators provides a high electro-mechanical transformation efficiency, even when miniaturized, because they have a small series resistance and a high quality factor, which are achieved by providing grooves or a step difference, and by electrode construction, on the tuning fork tines and/or tuning fork base. Improved frequency-temperature behaviour of the resonators of the present invention, over that of previously known resonators, is accomplished by integrally connecting a plurality of resonators at their respective tuning fork bases. Resonators having different peak temperature points are electrically connected in parallel. Integrally formed quartz crystal tuning fork resonators according to the present invention exhibit excellent frequency-temperature behaviour characteristics over a wide temperature range of from about -10°C to about +50°C.